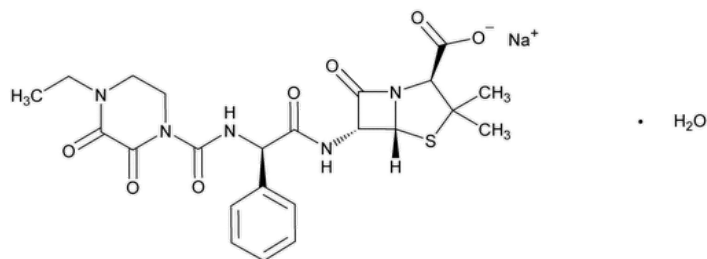


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Piperacillin Sodium



$C_{23}H_{26}N_5NaO_7S$ 539.54

4-Thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid, 6-[[[(4-ethyl-2,3-dioxo-1-piperazinyl)carbonyl]amino]phenylacetyl]amino]-3,3-dimethyl-7-oxo-, monosodium salt, [2S-[2 α ,5 α ,6 β (S*)]];

Sodium (2S,5R,6R)-6-[(R)-2-(4-ethyl-2,3-dioxo-1-piperazinecarboxamido)-2-phenylacetamido]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylate CAS RN[®]: 59703-84-3.

DEFINITION

Piperacillin Sodium has a potency equivalent to NLT 863 μ g/mg and NMT 1007 μ g/mg of piperacillin ($C_{23}H_{27}N_5O_7S$), calculated on the anhydrous basis.

IDENTIFICATION

- **A.** The retention time of the major peak of the *Sample solution* corresponds to that of the *Standard solution*, and the chromatogram compares qualitatively to that of the *Standard solution*, as obtained in the Assay.
- **B.** [IDENTIFICATION TESTS—GENERAL \(191\)](#), [Chemical Identification Tests, Sodium](#): Meets the requirements

Add the following:

- ▲ **C.** The UV spectrum of the major peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the Assay. ▲ (USP 1-Dec-2019)

ASSAY

Change to read:

PROCEDURE

Mobile phase: [Methanol](#), [water](#), 0.2 M [monobasic sodium phosphate](#), and [0.4 M tetrabutylammonium hydroxide](#) (450:447:100:3). Adjust with [phosphoric acid](#) to a pH of 5.50.

System suitability solution: 0.1 mg/mL of [USP Ampicillin RS](#) and 0.2 mg/mL of [USP Piperacillin RS](#) in *Mobile phase*

Standard solution 1: 0.4 mg/mL of [USP Piperacillin RS](#) in *Mobile phase*. Dissolve in a few drops of [methanol](#), and dilute with *Mobile phase* to volume. Use this solution within 1 h.

Sample solution: 0.4 mg/mL of Piperacillin Sodium in *Mobile phase*

Chromatographic system

(See [Chromatography \(621\)](#), [System Suitability](#).)

Mode: LC

Detector: UV 220 nm. ▲For *Identification C*, use a diode array detector in the range of 190–400 nm. ▲ (USP 1-Dec-2019)

Column: 4.6-mm $\times$ 25-cm; 5- μ m packing [L1](#)

Flow rate: 1 mL/min

Injection volume: 10 μ L

System suitability

Samples: *System suitability solution* and *Standard solution 1*

[NOTE—See [Table 1](#) for the relative retention times.]

Suitability requirements

Resolution: NLT 16 between ampicillin and piperacillin, *System suitability solution*

Tailing factor: NMT 1.2 for piperacillin, *System suitability solution*

Relative standard deviation: NMT 2% for piperacillin, *Standard solution 1*

Analysis

Samples: *Standard solution 1* and *Sample solution*

Calculate the potency, in µg/mg, of piperacillin ($C_{23}H_{27}N_5O_7S$) in the portion of Piperacillin Sodium taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times P$$

r_U = peak response from the *Sample solution*

r_S = peak response from *Standard solution 1*

C_S = concentration of [USP Piperacillin RS](#) in *Standard solution 1* (mg/mL)

C_U = concentration of Piperacillin Sodium in the *Sample solution* (mg/mL)

P = potency of piperacillin in [USP Piperacillin RS](#) (µg/mg)

Acceptance criteria: 863–1007 µg/mg on the anhydrous basis

IMPURITIES

• PIPERACILLIN PENICILLOIC ACID AND ACETYLATED PENICILLOIC ACID OF PIPERACILLIN

Mobile phase, System suitability solution, Standard solution 1, and Sample solution: Prepare as directed in the Assay.

Standard solution 2: 0.04 mg/mL of [USP Piperacillin RS](#) in *Mobile phase*. Dissolve in a few drops of [methanol](#), and dilute with *Mobile phase* to volume. Use this solution within 1 h.

Chromatographic system

(See [Chromatography \(621\)](#), *System Suitability*.)

Mode: LC

Detector: UV 220 nm

Column: 4.6-mm × 25-cm; 5-µm packing [L1](#)

Flow rate: 1 mL/min

Injection volume: 10 µL

System suitability

Samples: *System suitability solution* and *Standard solution 1*

[NOTE—See [Table 1](#) for the relative retention times.]

Suitability requirements

Resolution: NLT 16 between ampicillin and piperacillin, *System suitability solution*

Tailing factor: NMT 1.2 for piperacillin, *System suitability solution*

Relative standard deviation: NMT 2% for piperacillin, *Standard solution 1*

Analysis

Samples: *Sample solution* and *Standard solution 2*

Calculate the percentages of piperacillin penicilloic acid and acetylated penicilloic acid of piperacillin in the portion of Piperacillin Sodium taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times P \times (1/F_1) \times F_2 \times 100$$

r_U = peak response of piperacillin penicilloic acid or acetylated penicilloic acid of piperacillin from the *Sample solution*

r_S = peak response of piperacillin from *Standard solution 2*

C_S = concentration of [USP Piperacillin RS](#) in *Standard solution 2* (mg/mL)

C_U = concentration of Piperacillin Sodium in the *Sample solution* (mg/mL)

P = potency of piperacillin in [USP Piperacillin RS](#) (µg/mg)

F_1 = relative response factor (see [Table 1](#))